MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

PPS0016 – INTRODUCTION TO PROBABILITY AND STATISTICS

(All Sections / All Groups)

16 OCT 2017

9:00 AM – 11:00 AM

(2 Hours)

GENERAL INSTRUCTIONS:

1. This exam paper consists of **5 pages** (including the cover and appendix) with **5 questions only**.
2. Each question is worth **20 marks. Attempt ALL questions.**
3. A normal distribution table is provided in the appendix.
4. Write all your answers in the answer booklet provided. **Show all relevant steps** to obtain maximum marks.

Question 1

Consider the following sample of highest temperatures (in Fahrenheit) of 30 selected world cities on a September day.

62	72	66	79	83	61	85	72	64	74
71	42	38	91	66	77	90	74	63	64
68	42	62	47	62	83	71	56	39	78

a) Show **using formal methods of calculation** that the appropriate number of classes for the above data is 6 and that the appropriate class width is 9. [4 marks]

b) Prepare a **frequency distribution table** for the above data using the template as shown below. Use the lowest value of the above data as the lower limit of the first class.

Class limits	Class boundaries	Midpoint, m	Tally	Frequency, f	mf	m^2f	Cumulative frequency

[8 marks]

c) Estimate the **mean, mode, median** and **standard deviation** of the data based on the frequency distribution table. Round off final values to two decimal places. [8 marks]

Question 2

a) The following table shows the number of students taking Chemistry and Biology in a given lecture group of size 52:

Subject(s) Taken	Number of Students
Chemistry	33
Biology	40
Chemistry and Biology	x
Neither	5

(i) Draw a Venn diagram representing the above information. [3 marks]

(ii) Determine x, the number of students who are taking both Chemistry and Biology. [2 marks]

b) Given the digits 0, 1, 3, 4, 5, 7 and 9, how many **4 digit** numbers can be formed (without repetition), if

(i) there are no restrictions? [hint: first digit must be nonzero] [2 marks]

(ii) the numbers must be odd and less than 5000? [5 marks]

c) Ali has a choice of 3 modes of transport to get to work: his car, the bus and the MRT. Because of heavy traffic, taking his car means that his chances of being late is 45%. The bus is late only 23% of the time, but is usually overcrowded. Finally, the MRT is late only 3% of the time, but more expensive. He takes each mode with a relative frequency of 0.3, 0.45 and 0.25, respectively.

(i) Draw the probability tree diagram representing this information. [3 marks]

(ii) Given that he is late on a particular day, find the probability that he drove to work. [5 marks]

Question 3

a) A basket contains five equally shaped envelopes. Two of the envelopes contain a RM5 bill and the rest of the envelopes contain a RM1 bill. A girl randomly picks two envelopes from the basket and pockets the ringgit bills she finds inside. Let X be the amount of money in ringgits she receives from the envelopes. Prepare a **probability distribution table** of X and calculate the **expected amount of money** she receives from the envelopes. [5 marks]

b) A random variable X has its probability distribution function defined as follows:

$$f(x)=\begin{cases} m(4x-3) & 1<x<2 \\ mx & 2\le x<3 \\ 0 & \text{otherwise} \end{cases}$$

i) Find the value of the constant m and hence prepare a **cumulative distribution function** for the random variable X. [12 marks]

ii) **Using the cumulative distribution function** that you have prepared, find $P(1.5<X<2.5)$. Round off your final value to 4 decimal places. [3 marks]

Question 4

(a) A magic coin lands heads up 60% of the time. If the coin is tossed 5 times,

(i) find the probability that **at most** 3 heads will occur. [4 marks]

(ii) determine the mean and standard deviation of the number of heads. [4 marks]

(b) An engineer is gathering data on the distribution of metal defects along a steel beam. On average, the number of defects per meter is 2. Using the appropriate probability formula, find the probability that, on a randomly selected beam length of 2 meters, there will be 4 or 5 defects. [6 marks]

(c) Laundro fills boxes of laundry detergent at their factory. The mass, X kg, of each filled box can be modeled by a normal distribution with mean of 5.2 and standard deviation of 0.1. Find the mass that is **not exceeded** by 80% of the boxes. [6 marks]

Question 5

a) A tour bus company is advertising a vacation trip on a bus that holds 60 passengers. The company has found that, on average, 10% of ticket holders do not show up for such trips. Hence, the company routinely allow overbooking of such trips. Assume that passengers act independently of one another. If the company sells 65 tickets,

i) show that the distribution of proportion of ticket holders who show up is approximately normal. [3 marks]

ii) find the **probability** that the bus can hold all ticket holders who actually show up. [5 marks]

b) A manufacturer of canned beef determined that, based on decades of data, each can of beef contains an average of 135 mg of cholesterol with a standard deviation of 8 mg. A consumer association inspector randomly selected a sample of 36 cans of beef from the manufacturing line for inspection and testing.

i) Find the **probability** that the mean cholesterol content in the sample is less than 133 mg. [4 marks]

ii) Any can of beef that contains more than k mg of cholesterol is considered to have failed the inspection test. If one can of beef out of the sample failed the test, find the **value of k in three significant figures.** [5 marks]

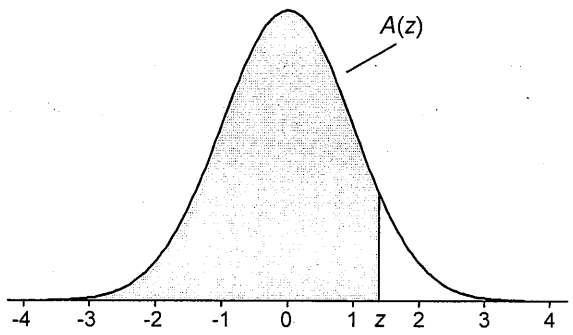
iii) Find the **percentage** of cans in the sample that has an average cholesterol content between 134 mg and 137 mg. [3 marks]

End of paper

Appendix

TABLE A.1

Cumulative Standardized Normal Distribution



$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							